REVISIONS			
LTR	DESCRIPTION	DATE (YR-MO-DA)	APPROVED
A	Added case outline Z package. Changed package height for case outline X from .325 inches max to .330 inches max. Rewrote entire document.	95-02-01	K. Cottongim

REV																				
SHEET																				
REV	A																			
SHEET	15																			

REV STATUS OF SHEETS	REV	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	SHEET	1	2	3	4	5	6	7	8	9	10	11	12	13	14

PMIC N/A

STANDARD MICROCIRCUIT DRAWING

THIS DRAWING IS AVAILABLE FOR USE BY ALL DEPARTMENTS AND AGENCIES OF THE DEPARTMENT OF DEFENSE

AMSC N/A

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DRAWING APPROVAL DATE
92-07-21

REVISION LEVEL
A

DEFENSE ELECTRONICS SUPPLY CENTER
DAYTON, OHIO 45444

MICROCIRCUIT, LINEAR, 5 VOLT, SINGLE CHANNEL, DC/DC CONVERTER, HYBRID

SIZE	CAGE CODE	
A	**67268**	**5962-91600**

SHEET 1 OF 15

1. SCOPE

1.1 Scope. This drawing forms a part of a one part - one part number documentation system (see 6.6 herein). This drawing describes device requirements for hybrid microcircuits to be processed in accordance with MIL-H-38534. Two product assurance classes, military high reliability (device class H) and space application (device class K) and a choice of case outlines and lead finishes are available and are reflected in the Part or Identifying Number (PIN). When available, a choice of radiation hardness assurance levels are reflected in the PIN.

1.2 PIN. The PIN shall be as shown in the following example:

5962	-	91600	01	H	X	X
Federal stock class designator	RHA designator (See 1.2.1)		Device type (See 1.2.2)	Device class designator (See 1.2.3)	Case outline (See 1.2.4)	Lead finish (See 1.2.5)
_____ Drawing number _____/						

1.2.1 Radiation hardness assurance (RHA) designator. Device classes H and K RHA marked devices shall meet the MIL-H-38534 specified RHA levels and shall be marked with the appropriate RHA designator. A dash (-) indicates a non-RHA device.

1.2.2 Device type(s). The device type(s) shall identify the circuit function as follows:

Device type	Generic number	Circuit function
01	AHF2805S/CH,AHF2805SF/CH	DC-DC CONVERTER, 12W, 5 V OUTPUT

1.2.3 Device class designator. This device class designator shall be a single letter identifying the product assurance level as follows:

Device class	Device requirements documentation
H or K	Certification and qualification to MIL-H-38534

1.2.4 Case outline(s). The case outline(s) shall be as designated in MIL-STD-1835 and as follows:

Outline letter	Descriptive designator	Terminals	Package style
X	See figure 1	8	Dual-in-line
Z	See figure 1	8	Flange package

1.2.5 Lead finish. The lead finish shall be as specified in MIL-H-38534 for classes H and K. Finish letter "X" shall not be marked on the microcircuit or its packaging. The "X" designation is for use in specifications when lead finishes A, B, and C are considered acceptable and interchangeable without preference.

1.3 Absolute maximum ratings. 1/

Input voltage	-0.5 V dc to +50 V dc
Power dissipation (P_D)	6 W
Lead soldering temperature (10 seconds)	300°C
Storage temperature range	-65°C to +150°C

1.4 Recommended operating conditions.

Input voltage	16 V dc to 40 V dc
Operating temperature range (T_C)	-55°C to +125°C
Output power	≤ 12 W

2. APPLICABLE DOCUMENTS

2.1 Government specifications, standards, and handbook. Unless otherwise specified, the following specifications, standards, and handbook of the issue listed in that issue of the Department of Defense Index of Specifications and Standards specified in the solicitation, form a part of this drawing to the extent specified herein.

SPECIFICATIONS

MILITARY

MIL-H-38534 - Hybrid Microcircuits, General Specification for.

STANDARDS

MILITARY

MIL-STD-883 - Test Methods and Procedures for Microelectronics.
MIL-STD-973 - Configuration Management.
MIL-STD-1835 - Microcircuit Case Outlines.

HANDBOOK

MILITARY

MIL-HDBK-780 - Standardized Military Drawings.

(Copies of the specifications, standards, and handbook required by manufacturers in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting activity.)

2.2 Order of precedence. In the event of a conflict between the text of this drawing and the references cited herein, the text of this drawing shall take precedence.

1/ Stresses above the absolute maximum rating may cause permanent damage to the device. Extended operation at the maximum levels may degrade performance and affect reliability.

3. REQUIREMENTS

3.1 Item requirements. The individual item requirements shall be in accordance with MIL-H-38534 and as specified herein.

3.2 Design, construction, and physical dimensions. The design, construction, and physical dimensions shall be as specified in MIL-H-38534 and herein.

3.2.1 Case outline(s). The case outline(s) shall be in accordance with 1.2.4 herein and figure 1.

3.2.2 Terminal connections. The terminal connections shall be as specified on figure 2.

3.2.3 Block diagram. The block diagram shall be as specified on figure 3.

3.3 Electrical performance characteristics. Unless otherwise specified herein, the electrical performance characteristics are as specified in table I and shall apply over the full specified operating temperature range.

3.4 Electrical test requirements. The electrical test requirements shall be the subgroups specified in table II. The electrical tests for each subgroup are described in table I.

3.5 Marking. Marking shall be in accordance with MIL-H-38534. The part shall be marked with the PIN listed in 1.2 herein. In addition, the manufacturer's PIN may also be marked as listed in QML-38534.

3.6 Manufacturer eligibility. In addition to the general requirements of MIL-H-38534, the manufacturer of the part described herein shall maintain the electrical test data (variables format) from the initial quality conformance inspection group A lot sample, produced on the certified line, for each device type listed herein. The data should also include a summary of all parameters manually tested, and for those which, if any, are guaranteed. This data shall be maintained under document revision level control by the manufacturer and be made available to the preparing activity (DESC-EC) upon request.

3.7 Certificate of compliance. A certificate of compliance shall be required from a manufacturer in order to supply to this drawing. The certificate of compliance submitted to DESC-EC shall affirm that the manufacturer's product meets the requirements of MIL-H-38534 and the requirements herein.

3.8 Certificate of conformance. A certificate of conformance as required in MIL-H-38534 shall be provided with each lot of microcircuits delivered to this drawing.

4. QUALITY ASSURANCE PROVISIONS

4.1 Sampling and inspection. Sampling and inspection procedures shall be in accordance with MIL-H-38534.

4.2 Screening. Screening shall be in accordance with MIL-H-38534. The following additional criteria shall apply:

a. Burn-in test, method 1015 of MIL-STD-883.

(1) Test condition A, B, C, or D. The test circuit shall be maintained by the manufacturer under document revision level control and shall be made available to either DESC-EC or the acquiring activity upon request. Also, the test circuit shall specify the inputs, outputs, biases, and power dissipation, as applicable, in accordance with the intent specified in test method 1015 of MIL-STD-883.

(2) T_C as specified in accordance with table I of method 1015 of MIL-STD-883.

b. Interim and final electrical test parameters shall be as specified in table II herein, except interim electrical parameter tests prior to burn-in are optional at the discretion of the manufacturer.

TABLE I. Electrical performance characteristics.

Test	Symbol	Conditions $-55^{\circ}C \le T_C \le +125^{\circ}C$ V_{IN} = 28 V dc ±5%, C_L = 0 unless otherwise specified	Group A subgroups	Device type	Limits		Unit
					Min	Max	
Output voltage	V_{OUT}	I_{OUT} = 0	1	All	4.95	5.05	V dc
			2,3		4.90	5.10	
Output current 1/	I_{OUT}	V_{IN} = 16, 28, and 40 V dc	1,2,3		0.0	2400	mA
Output ripple voltage 2/	V_{RIP}	V_{IN} = 16, 28, and 40 V dc, B.W. = 20 Hz to 2 MHz	1,2,3			60	mVp-p
Output power 1/	P_{OUT}	V_{IN} = 16, 28, and 40 V dc	1,2,3		12		W
Line regulation	VR_{LINE}	V_{IN} = 16, 28, and 40 V dc, I_{OUT} = 0, 1.2, and 2.4 A	1,2,3			25	mV
Load regulation	VR_{LOAD}	V_{IN} = 16, 28, and 40 V dc, I_{OUT} = 0, 1.2, and 2.4 A	1,2,3			50	
Input current	I_{IN}	I_{OUT} = 0, inhibit (pin 1) is converted to input return (pin 7)	1,2,3			12	mA
		I_{OUT} = 0, inhibit (pin 1) open				30	
Input ripple current	I_{RIP}	I_{OUT} = 2.4 A B.W. = 20 Hz to 2 MHz	1,2,3			50	mAp-p
Efficiency	Eff	I_{OUT} = 2.4 A	1		76		%
Isolation	ISO	Input to output or any pin to case (except pin 6) at 500 V dc	1		100		MΩ
Capacitive load 3/ 4/	C_L	No effect on dc performance	4			500	µF

See footnotes at end of table.

TABLE I. Electrical performance characteristics - Continued.

Test	Symbol	Conditions $-55^{\circ}C \le T_C \le +125^{\circ}C$ V_{IN} = 28 V dc ±5%, C_L = 0 unless otherwise specified	Group A subgroups	Device type	Limits		Unit
					Min	Max	
Power dissipation, load fault	P_D	Overload 5/	1	01		6	W
		Short circuit				2.0	
Switching frequency	F_S	I_{OUT} = 2.4 A	4,5,6		500	600	kHz
Output response to step transient load changes 6/	VO_{TLOAD}	50% load to/from 100% load			-300	+300	mV pk
		No load to/from 50% load			-500	+500	
Recovery time, step transient load changes 6/ 7/	TT_{LOAD}	50% load to/from 100% load				70	µs
		No load to 50% load				1200	
		50% load to no load				8	ms
Output response to transient step line changes 4/ 8/	VO_{TLINE}	Input step from 16 to 40 V dc I_{OUT} = 2.4 A				500	mV pk
		Input step from 40 to 16 V dc I_{OUT} = 2.4 A				500	
Recovery time, transient step line changes 4/ 7/	TT_{LINE}	Input step from 16 to 40 V dc I_{OUT} = 2.4 A				800	µs
		Input step from 40 to 16 V dc I_{OUT} = 2.4 A				800	
Turn-on overshoot	$Vton_{OS}$	I_{OUT} = 0, and 2.4 A				600	mV pk
Turn-on delay 9/	Ton_D	I_{OUT} = 0, and 2.4 A				20	ms
Load fault recovery 4/	Tr_{LF}					20	

See footnotes at end of table.

TABLE I. Electrical performance characteristics - Continued.

1/ Parameter guaranteed by line and load regulation tests.

2/ Bandwidth guaranteed by design. Tested for 20 kHz to 2 mHz.

3/ Capacitive load may be any value from 0 to the maximum limit without compromising DC performance. A capacitive load in excess of the maximum limit will not disturb loop stability but will interfere with the operation of the load fault detection circuitry, appearing as a short circuit during turn on.

4/ Parameter shall be tested as part of design characterization and after design or process changes. Therefore shall be guaranteed to the limits specified in table I.

5/ An overload is that condition with a load in excess of the rated load but less than that necessary to trigger the short circuit protection and is the condition of maximum power dissapation.

6/ Load step transition time between 2 and 10 microseconds.

7/ Recovery time is measured from the initiation of the transient to where V_{OUT} has returned to within ±1 percent of V_{OUT} at 50 percent load.

8/ Input step transition time between 2 and 10 microseconds. Parameter guaranteed by design but not 100 percent tested.

9/ Turn-on delay time measurement is for either a step application of power at the input or the removal of a ground signal from the inhibit pin (pin 1) while power is applied to the input.

Case X

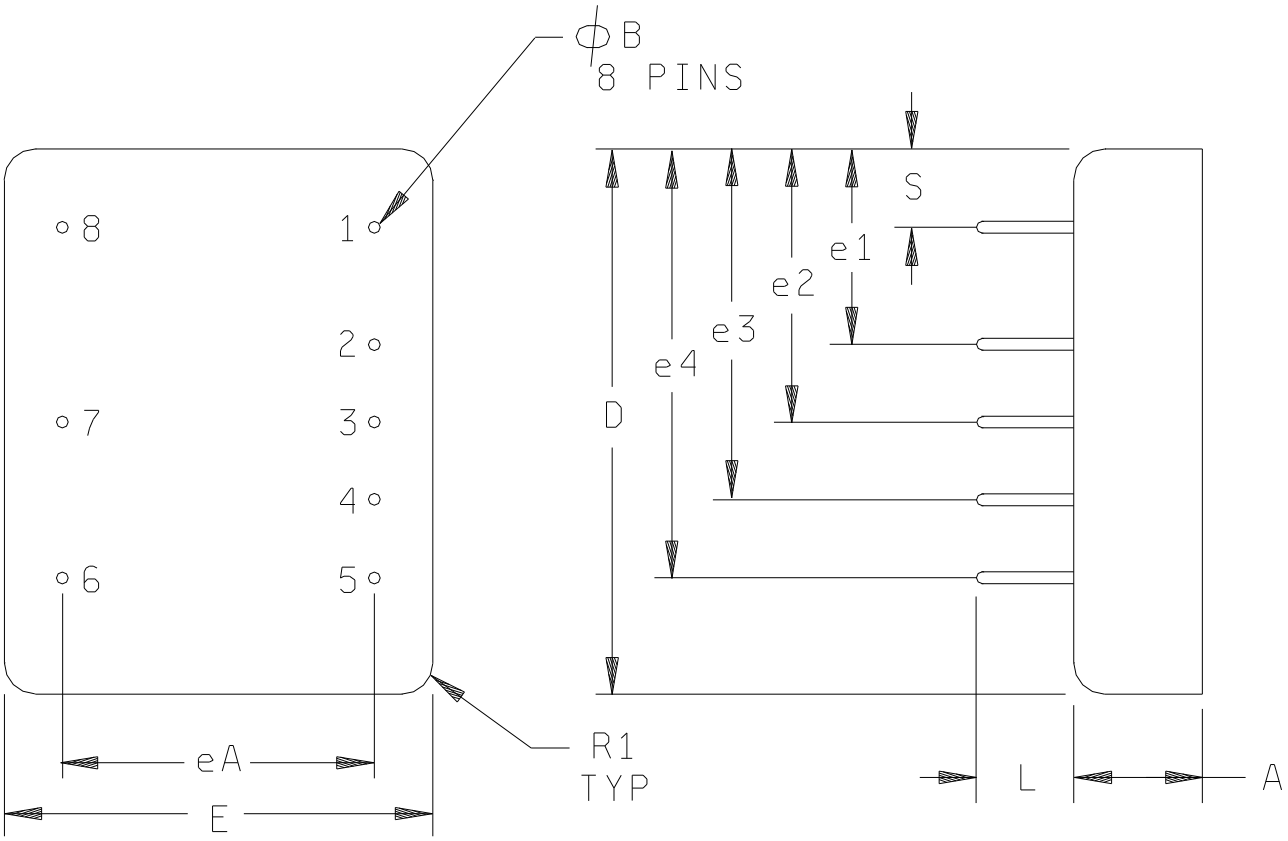

FIGURE 1. Case outlines.

STANDARDIZED MILITARY DRAWING DEFENSE ELECTRONICS SUPPLY CENTER DAYTON, OHIO 45444	SIZE **A**		5962-91600
		REVISION LEVEL A	SHEET 8

Case X - Continued.

Symbol	Millimeters		Inches	
	Min	Max	Min	Max
A		8.38		0.330
ϕB	0.64	0.89	0.025	0.035
D	36.70	36.96	1.445	1.455
eA	20.19	20.45	0.795	0.805
e1	12.70	12.95	0.500	0.510
e2	17.78	18.03	0.700	0.710
e3	22.86	23.11	0.900	0.910
e4	27.94	28.19	1.100	1.110
E	28.32	28.58	1.115	1.125
L	6.35	6.86	0.250	0.270
R1	2.03	2.54	0.080	0.100
S	5.08	5.33	0.200	0.210

NOTES:
1. The case outline X was originally designed using inch-pound units of measurement, in the event of conflict between the metric and inch-pound units, the inch-pound shall take precedence.
2. Device weight: 30 grams maximum.

FIGURE 1. Case outlines - Continued.

Case Z

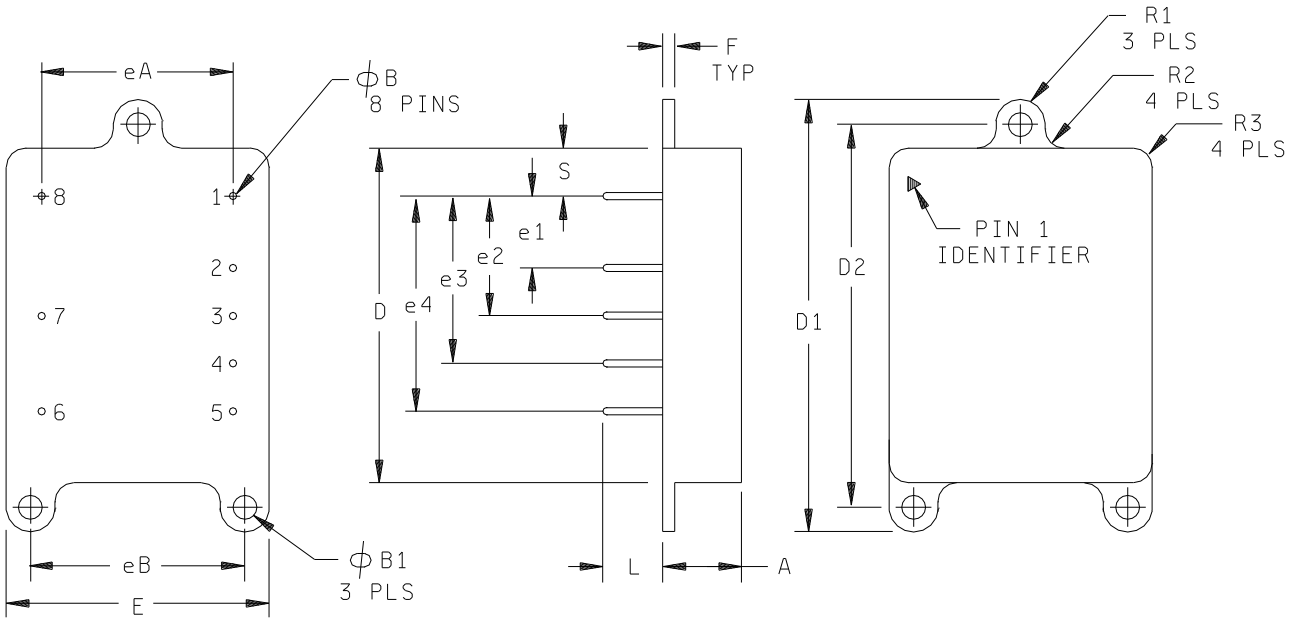

FIGURE 1. Case outlines - Continued.

Case Z - Continued.

Symbol	Millimeters		Inches	
	Min	Max	Min	Max
A		8.38		0.330
ϕB	0.64	0.89	0.025	0.035
B1	2.51	2.77	0.099	0.109
D	36.70	36.96	1.445	1.455
D1	48.01	48.51	1.890	1.910
D2	42.93	43.43	1.690	1.710
e1	7.37	7.87	0.290	0.310
e2	12.45	12.95	0.490	0.510
e3	17.53	18.03	0.690	0.710
e4	22.61	23.11	0.890	0.910
E	28.32	28.58	1.115	1.125
EA	20.07	20.57	0.790	0.810
EB	23.11	23.62	0.910	0.930
F	1.22	1.52	0.048	0.060
L	6.35	6.86	0.250	0.270
R1	2.29	2.79	0.090	0.110
R2	2.92	3.43	0.115	0.135
R3	2.03	2.54	0.080	0.100
S	8.13	8.64	0.320	0.340

NOTES:
1. The case outline Z was originally designed using inch-pound units of measurement, in the event of conflict between the metric and inch-pound units, the inch-pound shall take precedence.
2. Device weight: 38 grams maximum.

FIGURE 1. Case outlines - Continued.

Device type	01
Case outlines	X and Z
Terminal number	Terminal symbol
1	Inhibit
2	No connection
3	Output return
4	Output
5	No connection
6	Case ground
7	Input return
8	Input

FIGURE 2. Terminal connections.

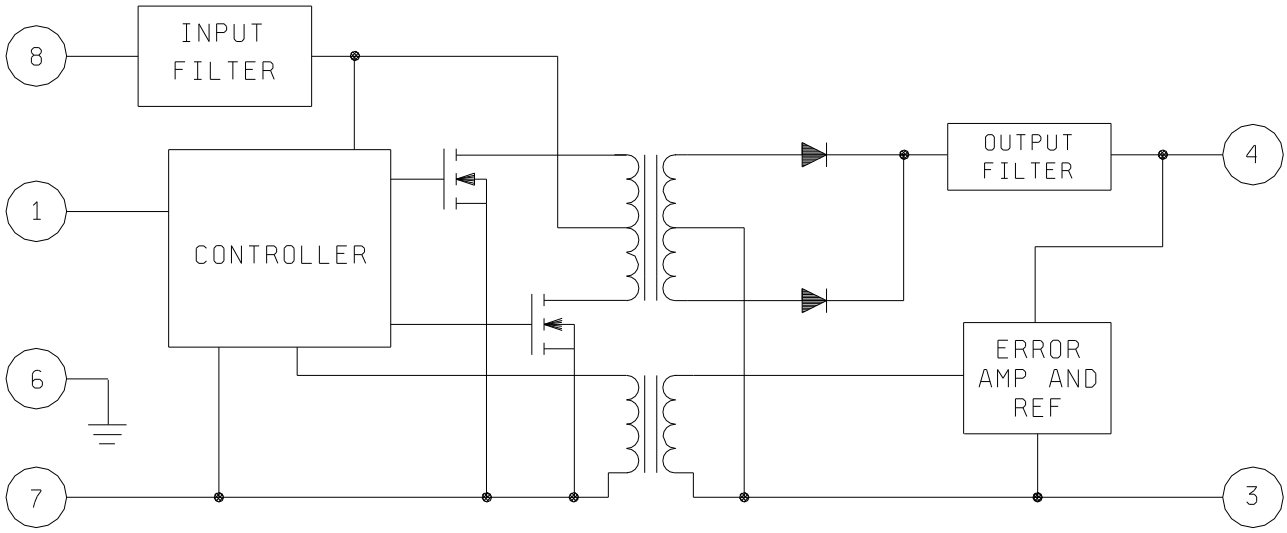

FIGURE 3. Block diagram.

TABLE II. Electrical test requirements.

MIL-H-38534 test requirements	Subgroups (in accordance with MIL-H-38534, group A test table)
Interim electrical parameters	
Final electrical test parameters	1*, 2, 3, 4, 5, 6
Group A test requirements	1, 2, 3, 4, 5, 6
Group C end-point electrical parameters	1, 4
MIL-STD-883, group E end-point electrical parameters for RHA devices	Subgroups ** (in accordance with method 5005, group A test table)

* PDA applies to subgroup 1.
** When applicable to this standardized military drawing, the subgroups shall be defined.

4.3 Quality conformance inspection. Quality conformance inspection shall be in accordance with MIL-H-38534 and as specified herein.

4.3.1 Group A inspection. Group A inspection shall be in accordance with MIL-H-38534 and as follows:

a. Tests shall be as specified in table II herein.

b. Subgroups 7, 8, 9, 10, and 11 shall be omitted.

4.3.2 Group B inspection. Group B inspection shall be in accordance with MIL-H-38534.

4.3.3 Group C inspection. Group C inspection shall be in accordance with MIL-H-38534 and as follows:

a. End-point electrical parameters shall be as specified in table II herein.

b. Steady-state life test conditions, method 1005 of MIL-STD-883.

(1) Test condition A, B, C, or D. The test circuit shall be maintained by the manufacturer under document revision level control and shall be made available to either DESC-EC or the acquiring activity upon request. Also, the test circuit shall specify the inputs, outputs, biases, and power dissipation, as applicable, in accordance with the intent specified in test method 1005 of MIL-STD-883.

(2) T_C as specified in accordance with table I of method 1005 of MIL-STD-883.

(3) Test duration: 1,000 hours, except as permitted by method 1005 of MIL-STD-883.

4.3.4 Group D inspection. Group D inspection shall be in accordance with MIL-H-38534.

4.3.5 Group E inspection. Group E inspection is required only for parts intended to be marked as radiation hardness assured (see 3.5 herein). RHA levels for device classes H and K shall be M, D, R, and H. RHA quality conformance inspection sample tests shall be performed at the RHA level specified in the acquisition document.

a. RHA tests for device classes H and K for levels M, D, R, and H shall be performed through each level to determine at what levels the devices meet the RHA requirements. These RHA tests shall be performed for initial qualification and after design or process changes which may affect the RHA performance of the device.

b. End-point electrical parameters shall be as specified in table II herein.

c. Prior to total dose irradiation, each selected sample shall be assembled in its qualified package. It shall pass the specified group A electrical parameters in table I for subgroups specified in table II herein.

d. For device classes H and K, the devices shall be subjected to radiation hardness assured tests as specified in MIL-H-38534 for RHA level being tested, and meet the postirradiation end-point electrical parameter limits as defined in table I at T_A = +25° C ±5 percent, after exposure.

e. Prior to and during total dose irradiation testing, the devices shall be biased to establish a worst case condition as specified in the radiation exposure circuit.

f. For device classes H and K, subgroups 1 and 2 in table V, method 5005 of MIL-STD-883 shall be tested as appropriate for device construction.

g. When specified in the purchase order or contract, a copy of the RHA delta limits shall be supplied.

5. PACKAGING

5.1 Packaging requirements. The requirements for packaging shall be in accordance with MIL-H-38534.

6. NOTES

6.1 Intended use. Microcircuits conforming to this drawing are intended for use for Government microcircuit applications (original equipment), design applications, and logistics purposes.

6.2 Replaceability. Microcircuits covered by this drawing will replace the same generic device covered by a contractor-prepared specification or drawing.

6.3 Configuration control of SMD's. All proposed changes to existing SMD's will be coordinated with the users of record for the individual documents. This coordination will be accomplished in accordance with MIL-STD-973 using DD Form 1692, Engineering Change Proposal.

6.4 Record of users. Military and industrial users shall inform Defense Electronics Supply Center when a system application requires configuration control and the applicable SMD. DESC will maintain a record of users and this list will be used for coordination and distribution of changes to the drawings. Users of drawings covering microelectronic devices (FSC 5962) should contact DESC-EC, telephone (513) 296-6047.

6.5 Comments. Comments on this drawing should be directed to DESC-EC, Dayton, Ohio 45444, or telephone (513) 296-5373.

6.6 One part - one part number system. The one part - one part number system described below has been developed to allow for transitions between identical generic devices covered by the three major microcircuit requirements documents (MIL-H-38534, MIL-I-38535, and 1.2.1 of MIL-STD-883) without the necessity for the generation of unique PIN's. The three military requirements documents represent different class levels, and previously when a device manufacturer upgraded military product from one class level to another, the benefits of the upgraded product were unavailable to the Original Equipment Manufacturer (OEM), that was contractually locked into the original unique PIN. By establishing a one part number system covering all three documents, the OEM can acquire to the highest class level available for a given generic device to meet system needs without modifying the original contract parts selection criteria.

Military documentation format	Example PIN under new system	Manufacturing source listing	Document listing
New MIL-H-38534 Standardized Military Drawings	5962-XXXXXZZ(H or K)YY	QML-38534	MIL-BUL-103
New MIL-I-38535 Standardized Military Drawings	5962-XXXXXZZ(Q or V)YY	QML-38535	MIL-BUL-103
New 1.2.1 of MIL-STD-883 Standardized Military Drawings	5962-XXXXXZZ(M)YY	MIL-BUL-103	MIL-BUL-103

6.7 Sources of supply for device classes H and K. Sources of supply for device classes H and K are listed in QML-38534. The vendors listed in QML-38534 have submitted a certificate of compliance (see 3.7 herein) to DESC-EC and have agreed to this drawing.

STANDARDIZED MICROCIRCUIT DRAWING SOURCE APPROVAL BULLETIN

DATE: 95-02-01

Approved sources of supply for SMD 5962-91600 are listed below for immediate acquisition only and shall be added to QML-38534 during the next revision. QML-38534 will be revised to include the addition or deletion of sources. The vendors listed below have agreed to this drawing and a certificate of compliance has been submitted to and accepted by DESC-ECT. This bulletin is superseded by the next dated revision of QML-38534.

Standard microcircuit drawing PIN	Vendor CAGE number	Vendor similar PIN 1/
5962-9160001HXX	52467	AHF2805S/CH
5962-9160001HZX	52467	AHF2805SF/CH

1/ Caution. Do not use this number for item acquisItion. Items acquired to this number may not satisfy the performance requirements of this drawing.

Vendor CAGE number	Vendor name and address
52467	Lambda Advanced Analog Incorporated 2270 Martin Avenue Santa Clara, CA 95050-2781